



LO Installation Steps and Technical Issues

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LO Installation

- Some preparations can be made without adversely impacting Run II data taking. Those would be carried out as natural opportunities arose.
 - ♦ Adapter card labeling and testing
 - ♦ Cable labeling and testing
 - ♦ Cooling and dry gas system servicing
 - ♦ LO transport, installation, and alignment fixturing
 - ♦ Safety documentation
- After accelerator shutdown, shielding outside the EC's would be opened and portions of beam pipe from the EC's to vacuum isolation valves near the low beta quads would be removed.
- EF's, CF's, and EC's would be opened and work platforms would be installed.

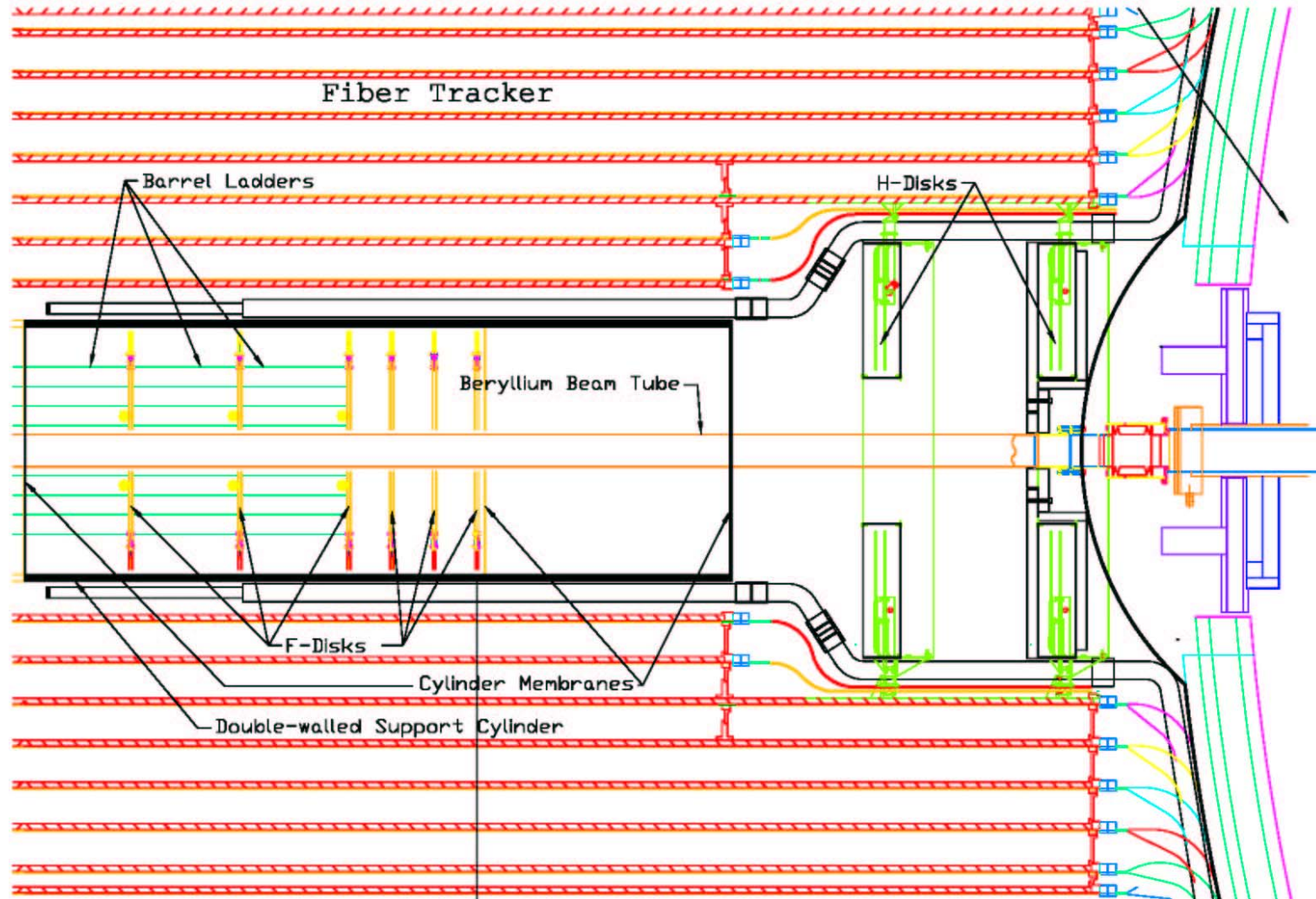


LO Installation Steps

- Removal of present components would follow the inverse sequence of installation.
 - ◆ Couplings from the beryllium pipe to the EC pipes would be disconnected.
 - ◆ The mating flange and bellows assemblies of EC pipes would be cut off.
 - ◆ EC pipes would be withdrawn into the EC's.
 - ◆ The present silicon would be warmed above ambient dew point.
 - ▲ We are checking the impact to existing silicon of such a temperature increase.
 - ◆ Outer dry gas enclosure membranes would be removed.
 - ▲ Dry air purge of 1 SCFM to each silicon enclosure and approximately 45 SCFM between the silicon and fiber tracker would be maintained to control dew points.



Dry Gas Purge Enclosures





EC Components

- EC bore components and tubing dimensions from drawing 3740.220-ME-295181:

Item	Description	OD (inches)	ID (inches)	Wall thickness (inches)
A	Tevatron beam tube	2.000	1.902	0.049
B	Magnetic shielding (2 layers)			
C	Warm tube	2.375	2.277	0.049
D	Warm tube heater			
E	Aluminized kapton superinsulation (15 layers)			
F	Cold tube	3.000	2.870	0.065
G	Inner hadronic calorimeter module tube	3.375	3.084	0.145



Beam Pipes

- Beryllium beam pipe dimensions from drawings 3823.110-MD-358897 and 3823.110-MD-399365:

Description	Distance (inches)	OD (inches)	ID (inches)	Wall thickness (inches)
Present beryllium beam tube				
Overall length	96.57			
Flange		1.700	1.460	
Beryllium tube		1.500	1.460	0.020
Splitter joint radial projection	0.065			
New beryllium beam tube				
Overall length	72.00			
Flange		1.200	0.960	
Beryllium tube		1.160	1.120	0.020



L0 Installation Steps

- ◆ Beryllium beam pipe restraints from the outer H-disks would be removed.
- ◆ The outer H-disks would be disconnected and removed using existing fixturing.
 - ▲ The beryllium beam pipe can be slid north-south approximately ± 12 inches to aid in H-disk work.
- ◆ The inner H-disks would be disconnected and removed.
 - ▲ Reproducible mounts allow H-disks to be reinstalled with a precision of about 3 μm .
- ◆ Fixturing would be installed and the beryllium beam pipe would be withdrawn into one of the EC pipes.
- ◆ Work platforms of that EC would be removed and the EC would be closed to allow removal of the beryllium beam pipe from its outer end.
- ◆ L0 would be brought in, along with its beryllium beam pipe, and placed in the EC beam pipe.

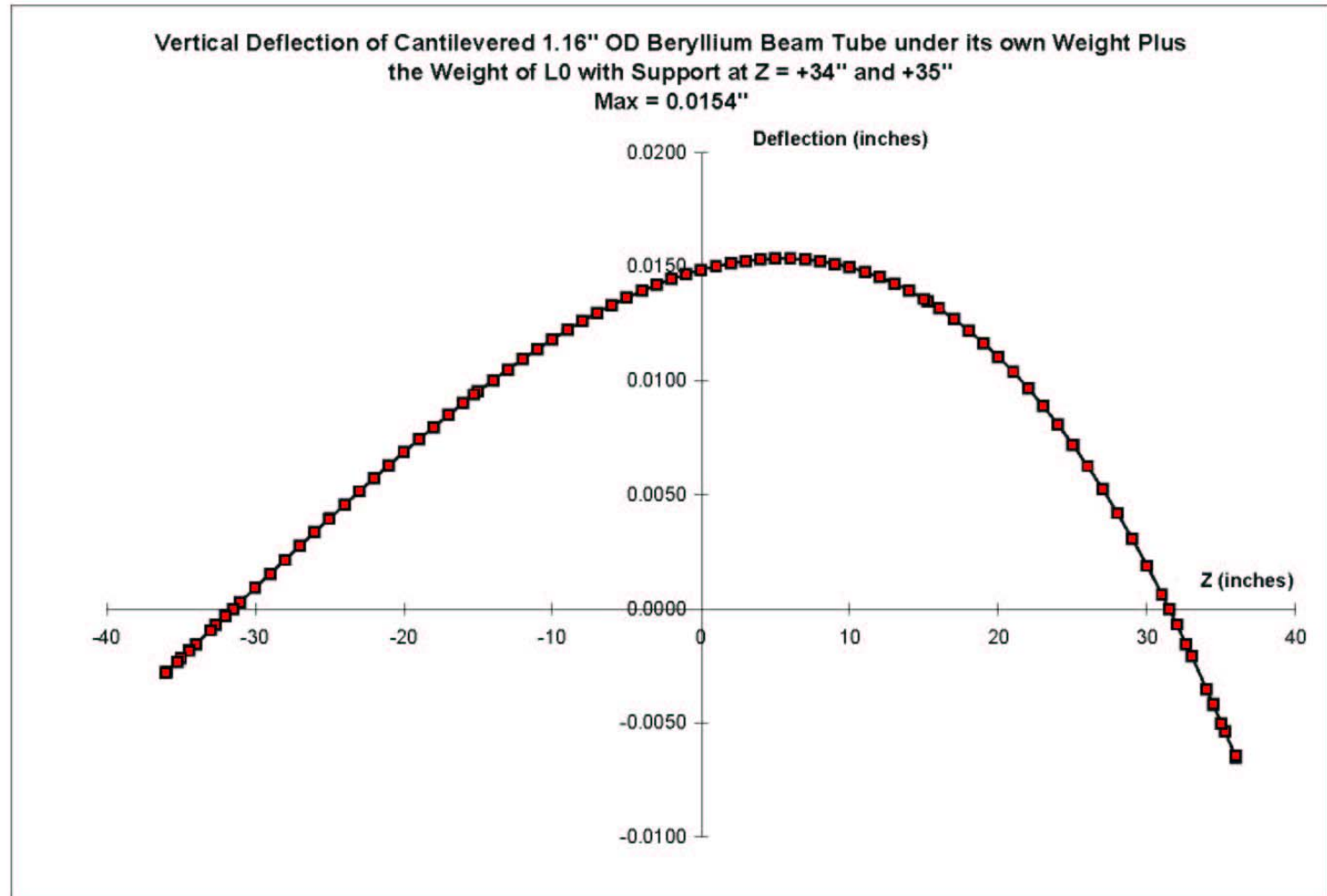


L0 Installation Steps

- ♦ The EC would be opened and work platforms would be reinstalled.
- ♦ We have not determined whether it will be necessary, but the openings in the silicon support cylinder outer membranes could be enlarged at this time.
- ♦ A L0 support table would be mounted on one work platform.
- ♦ L0 installation fixturing would be attached to the solenoid at 12 o'clock.
- ♦ L0 would be guided into place using cantilevered support via its beryllium beam pipe.
- ♦ L0 would be aligned longitudinally, transversely, and azimuthally and connected to the end membranes of the silicon support cylinder.
- ♦ We plan to simulate insertion and alignment at SiDet.



Deflection of the Beam Pipe within L0 with Cantilevered Support





L0 Installation Steps

- ♦ Beryllium pipe to EC pipe spools would be mated to the beryllium pipe. The assembly would be helium leak checked and L0 alignment would be rechecked.
- ♦ Beam pipe support (now supplemental) from the solenoid would be temporarily removed.
- ♦ Inner H-disks would be reinstalled.
- ♦ Supplemental beam pipe support from the solenoid would be reattached.
- ♦ Junction cards would be added.
- ♦ L0 and inner H-disk service and cable connections would be made.
- ♦ EC bellows and flange assemblies would be re-welded.
- ♦ Cabling and readout testing would be done.
- ♦ Outer H-disk shrouds (possibly without disks) would be re-installed.



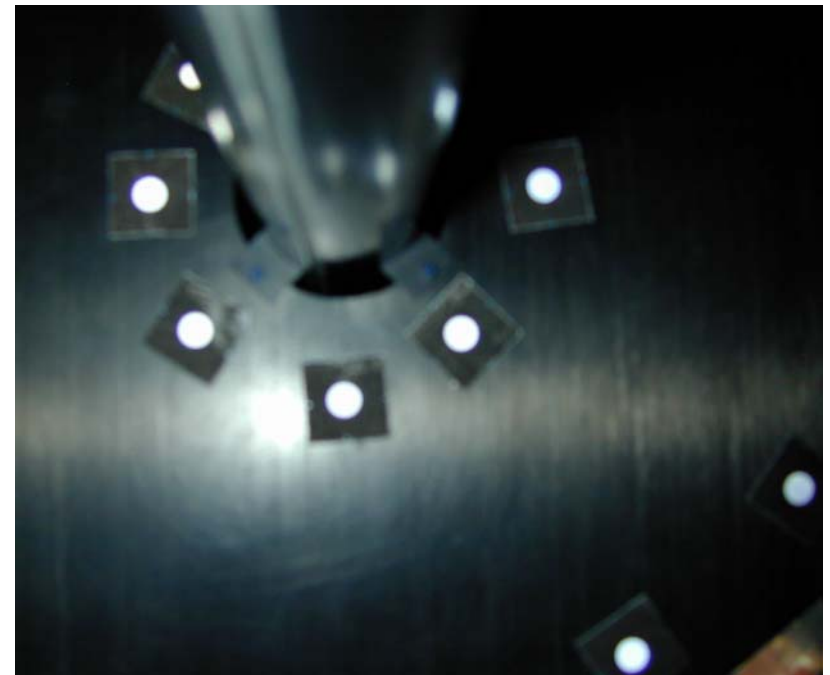
L0 Installation Steps

- ◆ Beam pipe supports from the outer H-disk shroud would be added.
- ◆ Gas enclosure membranes would be re-installed.
- ◆ Silicon cool-down would begin.
- ◆ Beam pipe flange joints would be made up and the beam pipe assembly would be leak checked.
- ◆ Beam pipes outside the EC's would be reconnected and leak checked.
- ◆ Shielding outside the EC's would be returned to its standard configuration.



Present Beam Pipe and Silicon

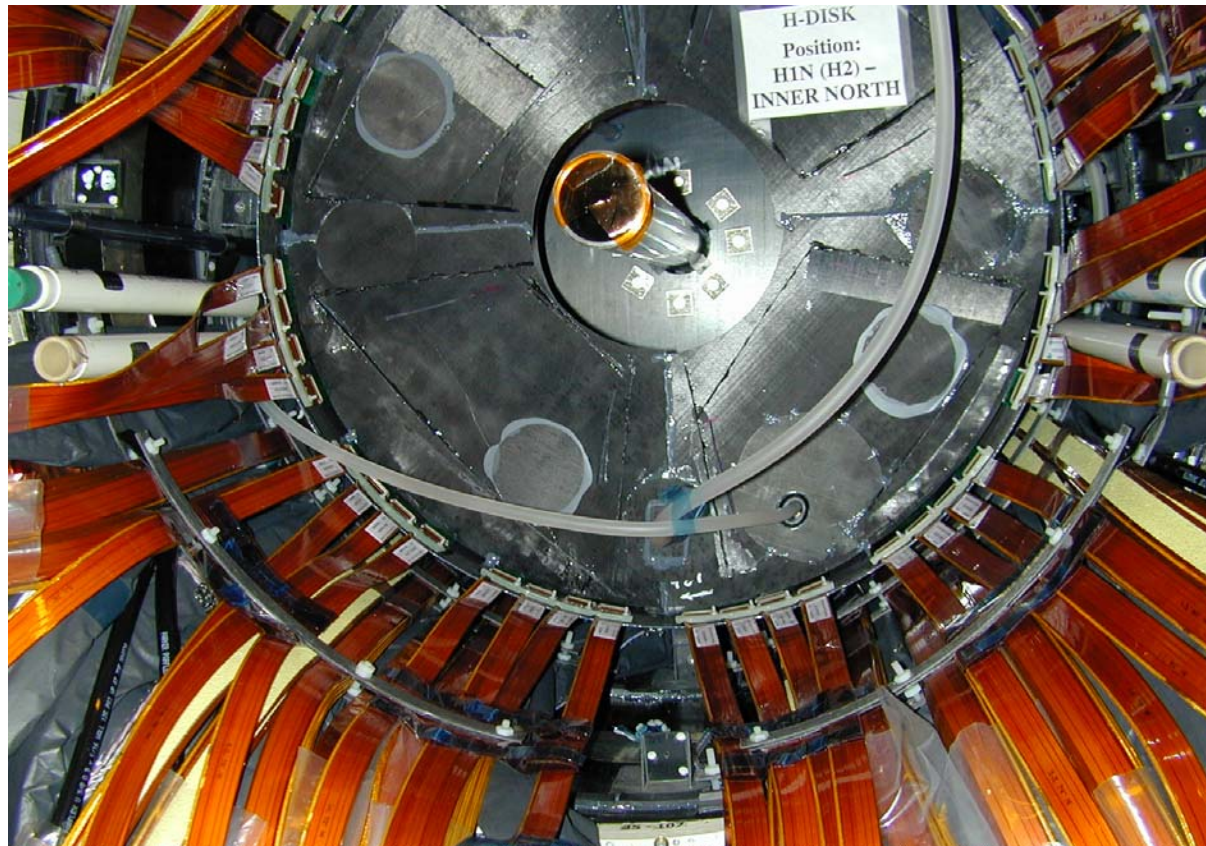
- Run IIa beam pipe was installed first, then the H-disks. The beryllium beam pipe is positioned from openings in the silicon support cylinder end membranes by Noryl spacers. The left photo shows the end of the beam pipe, a portion of the silicon support cylinder end membrane, and some of the V-STAR fiducials. The right photo shows two of the three beam pipe spacers at one end.





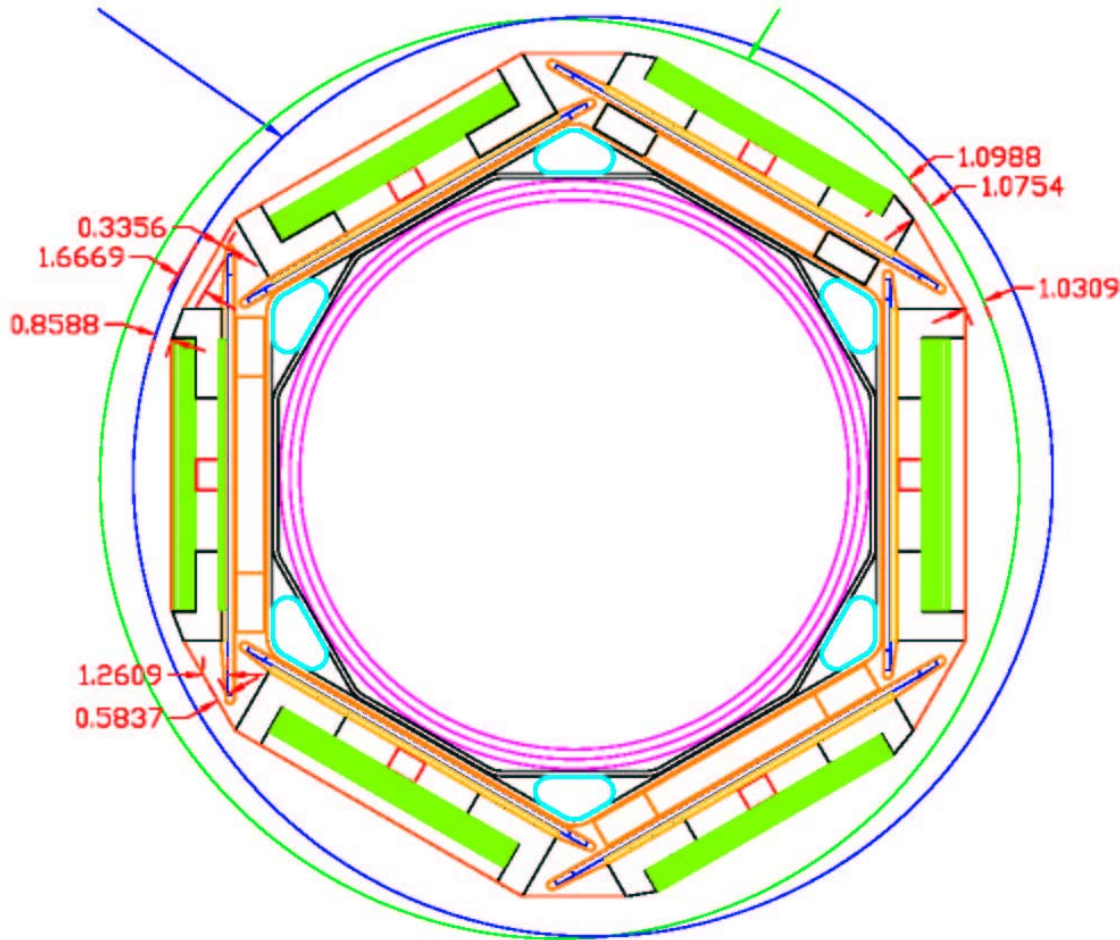
Inner H-disks

- The photo shows low-mass cables of an inner H-disk (48 total), its “shroud”, the ends of the inner sections of coolant distribution manifolds, and reproducible mounts for the outer H-disk.





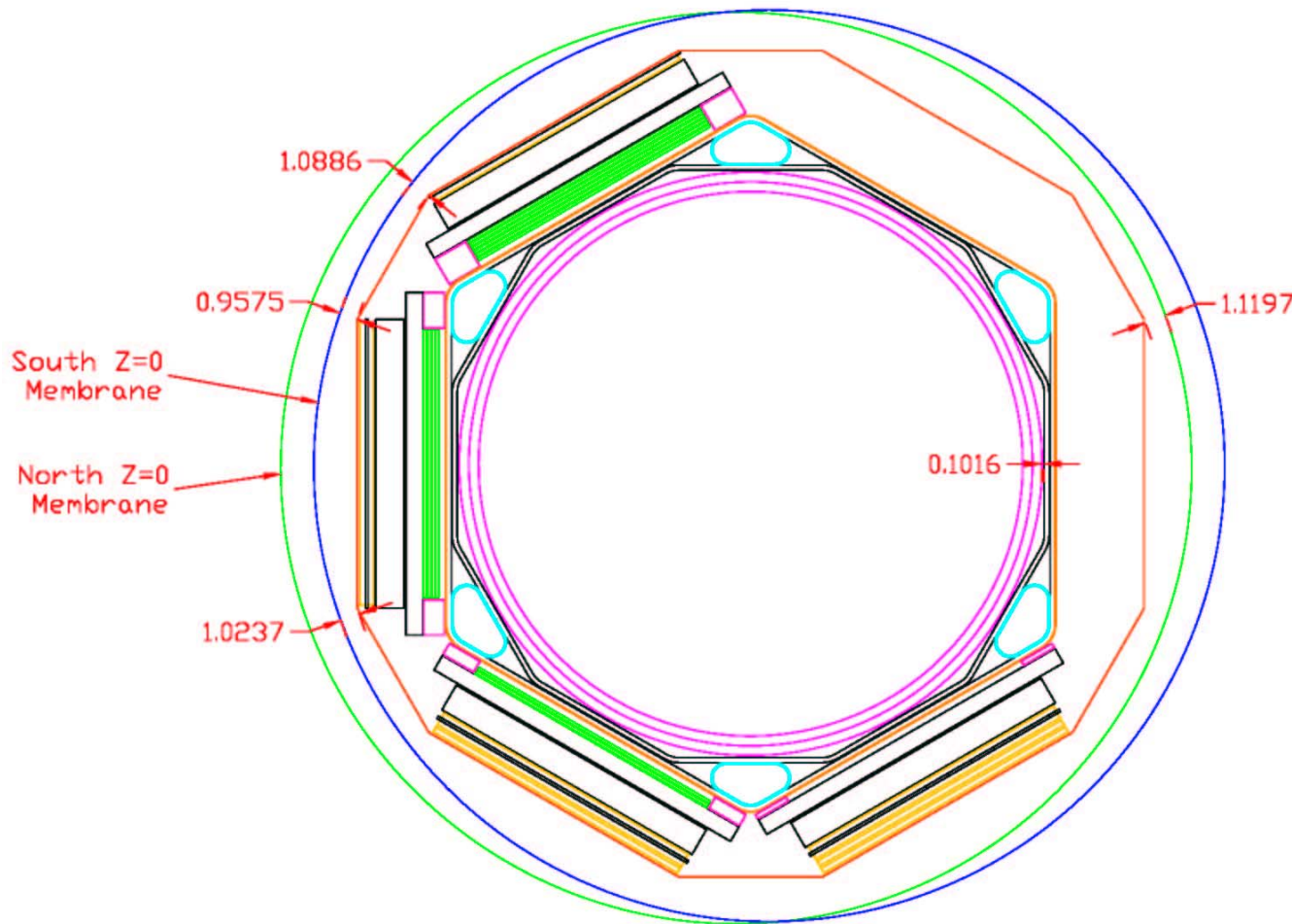
LO Clearances: Sensor Region



- Openings in $z = 0$ membranes are shown as blue and green circles
- Shown at the location with the greatest # of analogue cables; # of cables increases with z
- No conductive outer shell
- Worst installation clearance ~ 0.86 mm
- Run IIa beam tube installation clearance was ~ 1.18 mm



L0 Clearances: Hybrid Region



- Cable stacks are shown for the four hybrid z-locations.
- # of analogue cables decreases with z; # of digital cables increases
- Worst installation clearance ~0.96 mm